

From Documentation to Demonstrated Value: The Strategic Role of Emergency Medical Services (EMS) Data

By Brian Carnes

Alexis Barkett

Dr. Vanessa Millar, DBA

Abstract

Emergency Medical Services (EMS) operate at the intersection of urgent clinical care, public health, and increasingly value based healthcare financing. In this environment, rigorous data collection is more important than it has ever been. It is a strategic capability that determines whether agencies can demonstrate value, secure sustainable funding, improve clinical outcomes, and meet evolving regulatory expectations. Yet many EMS and mobile integrated healthcare–community paramedicine (MIH CP) programs identify data collection and monitoring as their single greatest challenge, underscoring the need for standardized metrics, interoperable systems, and an organizational culture of measurement and improvement.

Introduction

EMS is a critical component of the healthcare continuum, bridging prehospital care, acute episodes, and longitudinal population health strategies. As EMS roles expand, particularly through MIH CP programs that manage chronic conditions, reduce avoidable utilization, and connect patients with social support, data becomes the currency for proving impact. Many programs report that building reliable, comprehensive data systems is difficult. This challenge is felt acutely where EMS organizations must align stakeholders, train personnel, and integrate disparate technologies while keeping focus on patient care.

The EMS community's need for robust data is not theoretical. To gain support from payers and health system partners, EMS must show progress against what the Institute for Healthcare Improvement (IHI) calls the "Triple Aim." This framework includes better patient experience, improved population health, and lower per capita costs. Programs that quantify their outcomes against these aims are best positioned to move from pilot funding to durable contracts.

The Role of Data in Demonstrating EMS Value

Clear, credible data is essential to show how EMS interventions enhance patient experience (e.g., timely pain control, appropriate navigation to care), improve population health (e.g., chronic disease management, fall prevention), and reduce costs (e.g., avoidable ED visits and readmissions). MIH CP stakeholders explicitly note that proving performance on these aims is the most compelling argument for partners to invest.

Evidence of measurable impact fuels agreements with hospitals, home health and hospice agencies, skilled nursing facilities, Medicaid care coordination entities, managed care organizations, and behavioral health departments. EMS programs that present disciplined measurement, showing utilization reductions, improved outcomes, and patient satisfaction, are already earning such contracts. This momentum, though still early, demonstrates the market's preference for data driven arrangements and the centrality of EMS data systems in enabling them.

Financial Imperatives: From Cost Avoidance to Sustainable Funding

In an era of constrained budgets and value-based purchasing, EMS leaders must quantify the financial effects of their services. Data allows agencies to attribute reductions in emergency department utilization, hospital readmissions, frequent flyer transport, and low acuity conveyances to targeted EMS interventions. Such quantified savings provide the backbone of return on investment (ROI) analyses and shared savings models that partners require.

Beyond single year grants, durable EMS financing increasingly depends on value demonstration. Accurate, timely data informs contract negotiations with hospitals and payers, supports value-based reimbursement proposals, and strengthens grant applications—especially for rural and community paramedicine initiatives that must show high impact per dollar invested. As the MIH CP field emphasizes, data is the most powerful case for payer investment, converting anecdotes to evidence and pilots to scalable programs.

Accurate EMS documentation is a core financial control for modern EMS systems, not merely a clinical or compliance function. Patient care reports (PCRs/ePCRs), when integrated with dispatch and billing systems, form the primary evidentiary record used to support reimbursement, audit defense, supplemental funding eligibility, and long-term payment policy. Incomplete or inconsistent documentation increases the likelihood of claim denials, downcoding, delayed cash flow, and adverse audit findings, while also eroding the credibility of utilization and cost data used for financial modeling. National EMS data standards emphasize that encounter-level consistency is essential because downstream financial, regulatory, and policy decisions rely on the accuracy of information captured at the point of service rather than reconstructed retrospectively.

As EMS systems expand into Mobile Integrated Health (MIH), community paramedicine, and treatment-in-place models, the financial dependence on high-quality documentation becomes even more pronounced. Unlike traditional transport-based reimbursement, MIH programs rely on detailed clinical documentation to establish patient eligibility, medical necessity for non-transport care, scope of services delivered, practitioner credentials, and patient disposition or follow-up. These documentation elements must align across ePCRs, computer-aided dispatch (CAD) records, and billing systems to demonstrate that services were provided in accordance with approved program parameters. Federal initiatives that reimburse treatment in place and alternative destination transports underscored that non-transport EMS care is financially viable only when supported by robust, auditable documentation standards established by the Centers for Medicare & Medicaid Services (CMS).

Accurate and comprehensive documentation is also foundational to Medicaid supplemental payment programs, including fee-for-service supplemental payments, managed care directed payments, cost-based Certified Public Expenditure (CPE) arrangements, and payment-limit demonstrations. These programs require states and providers to substantiate both eligible utilization and allowable costs, which are derived from multiple interconnected data sources. CAD data establishes call volume, response characteristics, and system readiness workload; ePCRs document patient encounters, service types, and outcomes; ambulance billing data validate billed services, payer mix, and collections; and financial records support reported expenditures and revenues. Depreciation schedules for vehicles, medical equipment, and facilities are required to properly allocate capital costs over their useful lives, while operating expenditures such as labor, benefits, fuel, supplies, and contracted services must be clearly attributable to EMS operations. Weak documentation at any point in this data chain compromises audit defensibility and places supplemental funding at risk, as federal Medicaid policy requires verifiable, auditable support for both utilization and cost reporting.

These same data elements directly inform EMS rate setting by enabling accurate calculation of the cost of providing services. Rate-setting analyses rely on CAD and ePCR data to stratify service demand by call type, acuity, transport versus non-transport activity, time on task, and geographic coverage requirements. Financial data, including total operating expenditures, capital depreciation, and net revenue by payer, are then applied to these utilization measures to calculate unit costs per response, per transport, or per readiness hour. Ambulance

billing data further inform rate setting by illustrating payer mix, collection rates, and the gap between reimbursement and actual cost. When documentation is accurate and standardized, policymakers and actuaries can distinguish fixed readiness costs from variable service costs, resulting in reimbursement rates that more accurately reflect the true cost of providing EMS. National payment policy analyses have consistently emphasized the importance of reliable cost and utilization data in assessing ambulance payment adequacy.

The importance of documentation quality is further underscored by Medicare's Ground Ambulance Data Collection System (GADCS), which requires all ground ambulance organizations to report detailed information on costs, revenues, utilization, staffing, and capital assets. GADCS reporting drew directly from operational and financial datasets, including CAD-based call volumes, ePCR-derived service classifications, labor and operating expenditures, depreciation of vehicles and equipment, and ambulance billing revenue by payer. CMS made participation mandatory and imposed a ten percent Medicare payment reduction on organizations that failed to sufficiently report required data. Accurate, reconciled documentation across operational, billing, and financial systems reduces reporting errors, limits rework and strengthens confidence in the data used to inform future Medicare ambulance payment policy.

Taken together, accurate EMS documentation enables a closed-loop financial system in which operational activity, clinical care, billing, and financial reporting reinforce one another. High-quality data allows EMS agencies to demonstrate medical necessity, substantiate supplemental funding, comply with federal data-collection requirements, and support actuarially sound rate setting. As reimbursement models continue to evolve toward readiness-based and value-informed frameworks, documentation quality is no longer an administrative afterthought; it is a strategic financial asset that directly influences both current revenue and future payment policy.

Quality Improvement and Clinical Outcomes

Insufficient Data and the Impact on Patients

Without consensus on core elements and definitions, EMS agencies struggle to compare outcomes internally and externally. Divergent documentation practices, varying electronic health records (EHR) templates, and inconsistent coding impede aggregation and benchmarking.

Legacy systems, limited interoperability with hospital EHRs, and inadequate analytics capabilities slow progress. Even when software is available, integrating devices, CAD feeds, vitals monitors, and care pathways into a seamless data layer can be difficult—especially for small or rural agencies with limited IT support.

Standing up robust data infrastructure requires investment, not just in software licenses but in data engineering, analyst capacity, and staff training on documentation quality. Competing operational priorities and staffing pressures often push data work to the margins unless leadership explicitly prioritizes it.

Studies show that the quality of EMS data can be unsatisfactory due to deficiencies in the documentation process. Poor data has been linked to worse patient outcomes and can contribute to higher mortality rates. In the transfer of care process specifically, overall EMS data quality remains insufficient. Effective EMS to ED (emergency department) handoffs are negatively impacted by loss of information caused by miscommunication. Patient outcomes are at the core of EMS, and maintaining adequate documentation plays a crucial role in supporting them.

Prehospital EMS data collection is inherently challenging because information about injured patients is often limited, incomplete, or rapidly evolving at the point of care. EMS clinicians must make time critical assessments in uncontrolled environments, frequently with minimal diagnostic support, while simultaneously providing lifesaving interventions. Although prehospital data can be crucial for hospital teams preparing for definitive care, accurately

identifying which trauma patients will require early operative intervention remains difficult. The absence of widely adopted prehospital stratification tools further limits the ability to reliably translate field observations into actionable predictions for hospital readiness.

Another key challenge lies in the lack of prehospital appropriate clinical tools to support high risk decision making. While trauma centers use tiered activation criteria to improve triage and resource utilization, these systems rely heavily on limited field variables that may not fully capture injury severity. Studies have demonstrated that delays to operative care significantly increase mortality for trauma patients, yet EMS clinicians currently lack validated methods to identify surgical urgency before hospital arrival. Diagnostic modalities that improve prediction, such as ultrasonography, are generally unavailable in the prehospital setting, creating a gap between available data and clinical need.

Data exchange and integration present additional systemic barriers. EMS ePCRs must interface with hospital EHRs and, in some cases, health information exchanges (HIEs), yet there is little standardization in how this information is structured, stored, or displayed. Challenges include determining whether ePCR data should exist as standalone documents or be integrated throughout the EHR, as well as whether data transfer occurs automatically or requires active retrieval by hospital staff. Proprietary data systems and protected intellectual property restrict interoperability, limiting transparency and flexibility in how prehospital data flows across organizations.

Professional culture and established workflows can improve prehospital data collection and integration. EMS and hospital clinicians often operate within deeply ingrained protocols designed for efficiency and patient safety, making adoption of new data standards or technologies difficult. Overcoming resistance to workflow changes, and sustained uniformity across agencies and healthcare systems, can significantly increase the consistent use of prehospital data to inform early clinical decision making. Overcoming these cultural and operational barriers is essential to improving the quality, accessibility, and clinical impact of EMS data within the broader trauma care continuum. Recent Rural Health Transformation Fund grants, funded through the One Big Beautiful Bill, are a real time opportunity to apply for and invest in additional technology, interoperability, diagnostic equipment and telehealth.

Monitoring Program Effectiveness and Improvement Implementation

Proper EMS documentation is instrumental in monitoring program effectiveness and implementing regular improvements, especially for emerging programs like MIH-CP. For ambulance responses, data can be used to support decisions surrounding deployment, staffing, peak-demand utilization, and disaster response. State and regional policy makers use PCR data to guide funding and training resources, as well as to support decision-making on resource allocations. Similar data can also be used in conjunction with surrounding agencies as part of benchmarking efforts to drive area-wide advancements.

Accountability to Oversight Bodies

Accurate documentation and reproducible reporting practices enable transparency during audits, accreditation reviews, and quality investigations. Agencies with mature data systems can rapidly respond to external inquiries, demonstrate corrective actions, and show year over year improvements, strengthening public trust and institutional credibility.

“Why document? It’s required by your department for fire or rescue responses using National Fire Incident Reporting System (NFIRS) and for EMS responses by EMS authority in your state. Our memory is fallible and is especially fallible when your case comes to court, usually just at the end of the statutory period. For example, in many states, the statutory period is three years for medical malpractice or longer in other civil or criminal cases.” – John Murphy (JEMS 2022)

Different immunity laws exist in every state, however, an immunity statute does not stop someone from filing a lawsuit; it simply makes it more difficult for an allegedly wronged party to recover.

Aligning with Evolving Regulations

As healthcare continues its shift toward value-based care, EMS must align data systems with measures used by payers and public health authorities. Agencies that anticipate these demands by capturing outcomes, patient reported measures, and social determinants will be better positioned to remain compliant and relevant as rules evolve.

National data collection databases work to ensure consistency and accuracy in EMS data reporting. However, these data sets and standards change over time. Keeping up to date with the latest versions and technologies is critically important for a service to stay in compliance.

EMS agencies routinely submit patient care reports, report clinical metrics to state EMS offices, and contribute to national repositories such as the National Emergency Medical Services Information System (NEMSIS) and the National Trauma Data Bank (NTDB). Reliable data collection ensures that required elements are complete, accurate, and timely, reducing compliance risk and supporting system level planning.

NEMSIS is the national database that is used to store EMS data from states and territories. It is a universal standard for how patient care information resulting from an emergency 911 call for assistance is collected. In short, NEMSIS is a collaborative system to improve patient care through the standardization, aggregation, and utilization of point of care EMS data at a local, state and national level. NEMSIS is a product of NHTSA's Office of EMS and in collaboration with the University of Utah is the host of the Technical Assistance Center (TAC).

NEMSIS provides the framework for collecting, storing, and sharing standardized EMS data from states nationwide. The NEMSIS uniform dataset and database help local, state and national EMS stakeholders more accurately assess EMS needs and performance, as well as support better strategic planning for the EMS systems of tomorrow. Data from NEMSIS is also used to help benchmark performance, determine the effectiveness of clinical interventions, and facilitate cost-benefit analyses.

Additionally, The National EMS Quality Alliance (NEMSQA) provides nationally recognized, evidence-based quality measures of excellence. NEMSQA draws on data from NEMSIS to support quality improvement in EMS by linking standardized data collection with meaningful performance measurement. NEMSIS provides the foundation by ensuring EMS agencies across the country document patient care in a consistent, structured way, capturing details such as patient condition, treatments provided, and response times. This standardized data flows from local agencies to state and national databases, creating a large, comparable dataset that reflects real-world EMS care. Without this consistency, it would be difficult to analyze performance or identify trends across different systems.

Building on that foundation, NEMSQA uses NEMSIS data to create evidence-based quality measures that evaluate how well EMS providers deliver care. These measures allow agencies to benchmark their performance against regional and national standards, highlighting strengths and identifying areas needing improvement. By reviewing these insights, EMS systems can implement targeted changes such as training updates, protocol adjustments, or operational improvements, and then track progress over time using the same data-driven approach. Together, NEMSIS and NEMSQA form a continuous feedback loop that transforms raw data into actionable information, ultimately helping improve patient care and outcomes in EMS systems.

Participation, therefore, not only strengthens clinical care and operational decision-making but also enhances an agency's ability to secure funding, sustain operations, and invest in future improvements that benefit both providers and patients.

Recommendations: Building a High Reliability EMS Data System

Invest in interoperable EHR platforms:

Choose solutions that map to national data standards, exchange data with hospital and payer systems, and support automated extraction to analytics tools. Interoperability reduces duplicate documentation and enables longitudinal patient level insights.

Define and adopt standardized metrics:

Establish a core set of clinical, operational, financial, and patient reported measures aligned to the Triple Aim (e.g., pain relief within target windows, safe non transport with follow up, readmission within 7/30 days, avoidable ED utilization, patient satisfaction). Shared definitions support benchmarking and contracting.

Develop workforce capabilities:

Train field providers and supervisors on documentation quality, data literacy, and the “why” behind data collection. Build analyst capacity to transform raw fields into meaningful, actionable insights for clinical leadership and operations.

Forge data partnerships across the continuum:

Formalize data sharing agreements with hospitals, payers, public health, and social service organizations to quantify cross setting outcomes and costs. Such partnerships underpin value based contracts and help attribute avoided utilization to EMS interventions.

Institutionalize continuous quality improvement (CQI):

Embed dashboards and run charts in routine huddles and leadership reviews; create feedback loops from analytics to protocol updates and training curricula. Use PDSA cycles to test and scale effective practices.

Pursue research ready data:

Design data structures with future scholarships in mind. Uniform fields, clear time stamps, standardized outcomes so agencies can contribute to the peer reviewed literature the field still lacks at scale.

Conclusion

For EMS agencies, proper data collection is foundational, not optional, to mission and sustainability. Financially, it substantiates ROI and unlocks durable funding through contracts and value-based arrangements. Clinically, it powers continuous improvement, protocol refinement, and emerging evidence-based practice. Regulatorily, it ensures compliance and accountability as rules evolve toward outcome-oriented care. While barriers persist, particularly around standardization, technology, and workforce capacity, the path forward is clear: invest in interoperable systems, agree on core measures, develop data literate teams, and build partnerships that align incentives around measurable value. With these steps, EMS can translate frontline excellence into the metrics and narratives that shape policy, purchasing, and patient trust.

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About the Authors

Alexis Barkett

Consultant at Public Consulting Group

Ms. Alexis Barkett is a Consultant at PCG and has been with the firm since 2021. Since joining PCG, Ms. Barkett has supported a variety of School Based Services (SBS) and Ambulance Supplemental Payment Program (ASPP) Medicaid cost reporting projects. For the State of Utah School-Based Medicaid Program, Ms. Barkett oversaw the completion of Medicaid cost reports to identify possible reporting errors and worked closely with Local Education Agencies (LEAs) to ensure that finalized reports were completed accurately and in compliance with all reporting requirements. Ms. Barkett currently acts as the project manager for the Wisconsin Certified Public Expenditure (CPE) Program, as well as the Colorado EMS Supplemental Payment. Prior to joining PCG, Ms. Barkett acquired her bachelor's degree in Sociology from Siena College.

Brian J. Carnes

Senior Consultant at Public Consulting Group LLC

Mr. Brian Carnes brings 15 years of government relations experience working primarily in the public health and social services sectors. Mr. Carnes worked to improve health outcomes, expand health coverage and services to vulnerable populations, and introduce quality improvement metrics to state run programs. Most recently, Mr. Carnes worked with private sector Medicaid providers to drive quality results through innovative state funding mechanisms and grant projects.

Dr. Vanessa Millar, DBA

Consultant at Public Consulting Group LLC

Dr. Vanessa Millar is a Consultant located in Tampa, FL and has been with Public Consulting Group's (PCG) Healthcare Financial and Strategic Solutions (FSS) Center of Excellence, where she specializes in healthcare finance, reimbursement strategy, and financial consulting for governmental EMS providers. She currently serves as the Project Manager for Florida's Public Emergency Medical Transportation (PEMT) Program and New Mexico's Emergency Ground Ambulance Services (EGAS) Program, leading initiatives in Medicaid supplemental payment programs, cost reporting, reimbursement modeling, Cost of Service Analyses (COSA), and ambulance rate-setting. Dr. Millar holds a Bachelor of Science in Finance and a Master of Business Administration from the University of South Florida, as well as a Doctor of Business Administration in Project Management from Liberty University.

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Resources

National Emergency Medical Services Information System. NEMSIS Data Standards and National EMS Database Overview. <https://nemsis.org>

Centers for Medicare & Medicaid Services. Emergency Triage, Treat, and Transport (ET3) Model. <https://www.cms.gov/priorities/innovation/innovation-models/et3>

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